CLAIMS

What is claimed is:

1. A rotary position sensor 200, 300 having an axis of rotation A, A', A'', A''', comprising:

a magnet assembly 200', 300' having first and second poles 26, 28, 320, 322 wherein a working air gap 22'', 22''' is provided between the first and second poles 26, 28, 320, 322;

a magnetosensitive device 24'', 24''' having a reference point M, M', wherein the reference point M, M' is located within the working air gap 22'', 22''';

wherein the axis of rotation A, A', A'', A''' to the reference point M, M' is a first selected distance ***X, Y, Z, X*** greater than zero; and

wherein the working air gap 22'', 22''' is a second selected distance.

2. The sensor 200 of claim 1, the magnetosensitive device 24'' further having a reference direction T', the reference direction T' being oriented substantially perpendicular to an imaginary plane passing through the reference point M and the axis of rotation A, A', A''.

3. The sensor 200 of claim 2, further wherein the axis of rotation A, A', A'' is located along an imaginary line I between the first and second poles 26, 28.

4. The sensor 200 of claim 3, further wherein the axis of rotation A is located substantially midway C between the first and second poles 26, 28.

5. The sensor 200 of claim 3, wherein the magnet assembly 200' further comprises a magnetic element 16'', 18'' selected from the group consisting of a permanent magnet arc and a ring magnet.

6. The sensor 200 of claim 5, wherein the magnet assembly further comprises a flux carrying ring 20''; and

means for affixing the magnetic element 16'', 18'' to the flux carrying ring 20''.

7. The sensor 200 of claim 6, wherein the magnetic element 16'', 18'' is composed of Sm_2Co_{17}.

8. The sensor 200 of claim 3, wherein the magnet assembly 200' further comprises a magnetic element 16'', 18'' selected from the group consisting of a rectangular magnet and a bar magnet.

9. The sensor 200 of claim 3, wherein the first selected distance ***X*** is greater than about 0.4 mm.

10. The sensor 200 of claim 3, wherein the first selected distance ***X*** is greater than about 0.8 mm

11. The sensor 200 of claim 3, wherein the first selected distance ***X*** is about 2% to about 40% of the second selected distance.

12. The sensor 200 of claim 3, wherein the first selected distance ***X*** is about 8% to about 30% of the second selected distance.

13. The sensor 200 of claim 3, wherein the first selected distance ***X*** is about 15% to about 25% of the second selected distance.

14. The sensor 300 of claim 1, further wherein the axis of rotation A''' is located between the magnet assembly 300' and the

magnetosensitive device 24''' along a centerline I' of the magnet assembly 300' passing through the working air gap 22'''.

15. The sensor 300 of claim 14, the magnetosensitive device 24''' further having a reference direction T'', the reference direction T'' being oriented substantially parallel to an imaginary line passing through the reference point M' perpendicular to the axis of rotation A'''.

16. A rotary position sensor 300 having an axis of rotation A''', comprising:

a permanent magnet 316 having first and second poles 320, 322;

a first pole piece 310 wherein a portion thereof abuts the first pole 320, the first pole piece 310 having a first pole piece face 310f;

a second pole piece 312 wherein a portion thereof abuts the second pole 322, the second pole piece 312 having a second pole piece face 312f;

wherein a working air gap 22''' is provided between the first and second pole piece faces 320f, 322f;

a magnetosensitive device 24''' having a reference point M' wherein the reference point M' is located within the working air gap 22''';

wherein the axis of rotation A''' is substantially located between the permanent magnet 316 and the magnetosensitive device 24''' along a centerline I' of the permanent magnet 316 passing through the working air gap 22''';

further wherein the axis of rotation A''' to the reference point M' is a first selected distance ***X'*** greater than zero;

further wherein the working air gap 22''' is a second selected distance;

further wherein the permanent magnet 316 has a side facing the working air gap;

further wherein the side to the axis of rotation A''' is a third selected distance.

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17. The sensor 300 of claim 16, the magnetosensitive device 24''' further having a reference direction T'', the reference direction T'' being oriented substantially parallel to an imaginary line passing through the reference point M' perpendicular to the axis of rotation A'''.

18. The sensor 300 of claim 17, wherein the first selected distance ***X'*** is greater than about 0.4 mm.

19. The sensor 300 of claim 17, wherein the first selected distance ***X'*** is greater than about 0.8 mm.

20. The sensor 300 of claim 17, wherein the first selected distance ***X'*** is about 4% to about 70% of the second selected distance.

21. The sensor 300 of claim 17, wherein the first selected distance ***X'*** is about 10% to about 50% of the second selected distance.

22. The sensor 300 of claim 17, wherein the first selected distance ***X'*** is about 13% to about 37% of the second selected distance.

23. The sensor 300 of claim 20, wherein the third selected distance is from about 15% to about 70% of the second selected distance.

24. The sensor 300 of claim 20, wherein the third selected distance is from about 25% to about 50% of the second selected distance.

25. The sensor 300 of claim 20, wherein the third selected distance is from about 30% to about 35% of the second selected distance.

26. The sensor 300 of claim 20, wherein the permanent magnet 316 is composed of Sm_2Co_{17}.

27. The sensor 300 of claim 20, wherein the first and second pole pieces 310, 312 are composed of ferromagnetic material.